A sedimentological perspective on terrestrial plant hydrogen-isotope palaeohydrological proxy

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The $^{2}H/^{1}H$ composition of organic compounds from terrestrial plants has been steadily gaining popularity as a proxy for palaeohydrology. Even though there is a general understanding of the link between the $\delta^{2}H$ values of precipitation and *n*-alkyl lipids, there remain several major challenges that need to be addressed when using this proxy in the geological record. The purpose of this contribution is to clarify some of these challenges and to provide an improved understanding of how and in what context leaf wax hydrogen isotope data can be used as a proxy for palaeohydrology.

First, it is not always clear to what extent shifts in the contribution of isotopically different plant material through time could influence the sedimentary $\delta^{2}H$ record. Second, certain depositional settings are particularly conducive to diagenetic reworking of leaf and root derived biomass and a significant contribution from soil derived compounds. Third, in certain depositional settings, plant waxes can be transported large distances via river and air. Fourth, a sedimentry deposit could accumulate organic compounds derived from aged soils and sedimentary rocks of different ages.

Several proxy validation studies have used either leaf waxes from extant land plants or sedimentary biomarkers in lacustrine and soil deposits to show a link between the $\delta^{2}H$ values of environmental water and leaf waxes across broad, climatically different regions. Even though such studies clearly demonstrate correlation between the two variables across space, caution has to be applied when a temporal component is involved, i.e. when dealing with the sedimentary record. The issue might be particulary acute when the investigation focuses on a single locality where a combination of the factors discussed above might be at play.

This review will evaluate the challenges associated with the application of terrestrial plant-derived $\delta^{2}H$ record in wetlands, mountainous and lacustrine settings, as well as coastal and open marine environments. Particular consideration will be given to the potential role of – and thus the extent of uncertainty due to – each of the above four factors that might complicate interpretation of the sedimentary $\delta^{2}H$ record in these settings.